#### UIC.02USU1 (CV107/NPU)

#### **CLAIM AMENDMENTS**

The present listing of claims replaces all prior versions and listings of claims in the subject patent application.

### **Listing of Claims:**

Claim 1 (currently amended): A method for generating ultrabright multikilovolt coherent tunable radiation in the x-ray region of the electromagnetic spectrum, comprising:

- (a) generating pulsed laser radiation having a chosen power, pulsewidth and wavelength;
- (b) generating atomic clusters having a chosen size and density;
- (c) directing the laser radiation into the atomic clusters wherein rapid atomic excitation is generated having selected inner-shell electron atomic electrons being removed from the atoms without the removal of all of the electrons in the next outermost shell, thereby generating a population inversion from which a chosen wavelength of radiation is amplified or spontaneously generated in the x-ray region of the electromagnetic spectrum, and wherein the generated or amplified radiation is propagated in a self-trapped plasma channel region additionally having a nonlinear mode of confined propagation for the chosen wavelength of radiation; and
- (d) simultaneously controlling the density of said atomic clusters, the density of plasma electrons, and the laser radiation such that the wavelength of amplification is defined.

Claim 2 (original): The method as described in claim 1, wherein the cluster size is chosen to minimize the laser intensity required to excite substantially all of the atoms in the cluster.

Claim 3 (original): The method as described in claim 1, wherein the pulsewidth is chosen such that atomic excitation occurs on a timescale which is short compared with recombination processes in the plasma produced.

Claim 4 (original): The method as described in claim 3, wherein the pulsewidth is less than 1 ps.

## UIC.02USU1 (CV107/NPU)

Claim 5 (original): The method as described in claim 1, wherein the power and wavelength of the laser radiation, and the atoms in the clusters are chosen such that the desired x-ray wavelength is generated.

Claim 6 (original): The method as described in claim 5, wherein the atoms in the atomic clusters are heavy atoms.

Claim 7 (original): The method as described in claim 6, wherein the atoms include Xe and the laser radiation includes 248 nm radiation.

Claim 8 (original): An apparatus for generating ultrabright multikilovolt coherent tunable radiation in the x-ray region of the electromagnetic spectrum, comprising in combination:

- (a) a pulsed laser for generating radiation having a chosen power, pulsewidth and wavelength;
- (b) means for generating atomic clusters having a chosen size and density; and
- (c) means for directing the laser radiation into the atomic clusters wherein rapid atomic excitation is generated having selected inner-shell electron atomic electrons being removed from the atoms without the removal of all of the electrons in the next outermost shell, thereby generating a population inversion from which a chosen wavelength of x-radiation is amplified or spontaneously generated, and wherein the laser generated or amplified radiation is propagated in a self-trapped plasma channel region additionally having a nonlinear mode of confined propagation for the chosen wavelength of x-radiation; whereby if the density of said atomic clusters, the density of plasma electrons, and the laser radiation are simultaneously controlled, the spectrum of x-ray amplification is defined.

Claim 9 (original): The apparatus as described in claim 8, wherein the cluster size is chosen to minimize the laser intensity required to excite substantially all of the atoms in the cluster.

# UIC.02USU1 (CV107/NPU)

Claim 10 (original): The apparatus as described in claim 8, wherein the pulsewidth of the laser is chosen such that atomic excitation occurs on a timescale which is short compared with recombination processes in the plasma produced.

Claim 11 (original): The apparatus as described in claim 10, wherein the pulse width is less than 1 ps.

Claim 12 (original): The apparatus as described in claim 8, wherein the intensity and wavelength of the laser radiation, and the atoms in the clusters are chosen such that the desired x-ray wavelength is generated.

Claim 13 (original): The apparatus as described in claim 8, wherein the atoms in the clusters are heavy atoms.

Claim 14 (original): The apparatus as described in claim 13, wherein the atoms include Xe and the laser radiation includes 248 nm radiation.